ARTICLE X.

Astronomical Observations made at Hudson Observatory, Latitude 41° 14′ 40″ *North, and Longitude* 5 *h.* 25 *m.* 45 *s. West. By Elias Loomis, Professor of Mathematics and Natural Philosophy in Western Reserve College. Read April* 2*d and* 16*th*, 1841.

THE instruments of the observatory and the mode of using them have remained unchanged since my former paper was communicated to the Society, and the objects observed have been generally the same. The clock has been once stopped. In my former communication I remarked that the pendulum appeared to be over-compensated. This opinion was confirmed by subsequent observations, and on the 31st of January, 1840, 6.2 ounces of mercury were taken from the cistern, leaving the column 6.12 inches in height. Since that time the clock has been constantly running, and its rate has been tolerably satisfactory.

I. LATITUDE OF HUDSON OBSERVATORY.

During the past season I have observed nine culminations of Polaris. The observations were made alternately direct, and, by reflexion from mercury, generally a dozen at each culmination. The three microscopes were invariably read at each observation; the observations were reduced to the meridian by the usual method, and corrected for refraction by Bessel's tables. The errors of the microscopes were found to be as follow:

North Polar Distance.	A.	B.	C.	Mean.
358° 25′—30′	— 2″.6	+ 0″.1	+ 0″.2	— 0″.77
279 0 — 5	— 2 .2	— 0 .9	— 6 .6	— 3 .23

The following are the results of the observations:

Lower culmination of Polaris, June	4, 1840,	41° 14′ 40″.4
	8,	40 .2
	9,	42 .2
	13,	42 .3
	15,	42 .6
	16,	41 .3
	18,	45 .0
	19,	43 .1
	23,	43 .4
Mean of nine culminations,		41 14 42 .3

The result of last year's observations of Polaris was 41° 14′ 38″.1. The places of Polaris were taken from the Nautical Almanac, and the above results are both affected by the error of the tables, but with opposite signs, as the latter result was derived from upper, and the former from lower culminations. The mean of the two is 41° 14′ 40″.1, the value which I at present employ.

II. Observed Transits of the Moon and Moon culminating Stars at Hudson Observatory.

The following list is supplemental to that given on pages 49, 50. The observations are all reduced to the central wire. When the object is observed at all the wires, the reduction is equal to $0^s.112 \times$ secant of the declination, which correction is readily taken from a table, and is sensibly constant for all the following stars. When an object is not observed at all the wires, each observation is separately reduced to the central wire. For a star, this reduction is equal to the equatorial interval multiplied by the secant of the declination. For the moon this factor is computed by the formula

$$\frac{1 - \sin \pi \cos \phi \sec \delta}{3600 - A} . \ 3600 \sec \delta$$

Where $\pi =$ the moon's horizontal parallax.

$\phi =$ latitude of the place.

$\delta =$ moon's true declination.

$A =$ moon's hourly motion in right ascension, expressed in seconds of time.

Two imperfect transits of the moon contained in my former paper, namely, Nos. 29 and 35, were incorrectly reduced. The seconds should read, instead of

$41^s.39$	$41^s.23$
49 .70	49 .96

No.	Date.	Star.	No. Wires Obs.	Meridian Transit.	Clock's Rate.	No.	Date.	Star.	No. Wires Obs.	Meridian Transit.	Clock's Rate.
	1839.						1839.				
	Oct. 14	δ Sagittarii	5	$18^h\ 10^m\ 13^s.66$	$-0^s.23$		Nov. 16	φ Aquarii	5	$23^h\ 5^m\ 9^s.04$	$-0^s.87$
51		Moon 1 L.	5	18 50 17 .20				k′ Piscium	5	23 17 50 .58	
		τ Sagittarii	5	18 56 25 .74		62		Moon 1 L.	5	23 48 4 .20	
	15	τ Sagittarii	5	18 56 25 .50	− 0 .24			ω Piscium	4	23 50 12 .61	
		h^3 Sagittarii	5	19 26 27 .00				d Piscium	5	0 11 29 .06	
52		Moon 1 L.	5	19 47 2 .12			17	ω Piscium	5	23 50 12 .60	− 0 .20
		c Sagittarii	5	19 52 17 .80				d Piscium	5	0 11 28 .76	
		σ Sagittarii	5	20 9 38 .64		63		Moon 1 L.	5	0 41 7 .70	
	16	c Sagittarii	3	19 52 17 .41	− 0 .45			ε Piscium	5	0 53 45 .68	
		σ Capricorni	5	20 9 38 .12			18	ε Piscium	5	0 53 44 .40	− 1 .28
53		Moon 1 L.	5	20 42 33 .62		64		Moon 1 L.	3	1 37 31 .88	
		η Capricorni	5	20 54 46 .46				β Arietis	5	1 44 54 .18	
		ς Capricorni	5	21 6 22 .18				θ′ Arietis	3	2 8 19 .67	
	17	η Capricorni	5	20 54 45 .80	− 0 .74	65	19	Moon 1 L.	5	2 38 34 .24	− 0 .75
		ς Capricorni	5	21 6 21 .36				δ Arietis	5	3 1 34 .24	
54		Moon 1 L.	5	21 36 35 .64			22	β Tauri	5	5 15 13 .34	− 0 .94
		δ Capricorni	3	21 37 40 .63				κ Aurigae	5	6 4 12 .36	
55	18	Moon 1 L.	5	22 29 30 .08	− 1 .37	66		Moon 2 L.	5	6 8 9 .24	
		λ Aquarii	5	22 43 43 .20			1840.				
	20	λ Piscium	5	23 33 19 .18	− 0 .71		Feb. 15	6 Cancri	5	7 53 43 .82	− 0 .26
		q Piscium	5	23 53 3 .62				θ Cancri	5	8 22 30 .86	
56		Moon 1 L.	5	0 15 40 .82		67		Moon 1 L.	5	8 47 43 .80	
		δ Piscium	5	0 39 49 .44				ξ Cancri	5	9 0 12 .12	
	21	δ Piscium	5	0 39 47 .68	− 1 .76			q Cancri	5	9 10 5 .72	
57		Moon 1 L.	5	1 11 29 .20			Mar. 11	β Tauri	5	5 16 2 .92	− 0 .41
		η Piscium	5	1 22 20 .72				C. Tauri	5	5 43 8 .86	
		β Arietis	5	1 45 13 .42		68		Moon 1 L.	5	6 22 44 .74	
	22	η Piscium	5	1 22 19 .26	− 1 .42			ε Geminorum	5	6 33 58 .10	
		β Arietis	5	1 45 12 .08				τ Geminorum	5	7 0 50 .28	
58		Moon 1 L.*	5	2 10 50 .46			13	β Geminorum	5	7 35 23 .04	− 0 .40
		Moon 2 L.	5	2 13 16 .54				φ Geminorum	5	7 43 34 .32	
59	23	Moon 2 L.	5	3 16 57 .10	− 0 .61	69		Moon 1 L.	5	8 26 48 .18	
		η Tauri	5	3 37 21 .58				δ Cancri	5	8 35 27 .58	
		A′ Tauri	5	3 54 37 .38				α^2 Cancri	5	8 49 35 .98	
	24	η Tauri	5	3 37 21 .48	− 0 .29		17	π Leonis	5	11 28 36 .30	− 0 .32
		A′ Tauri	5	3 54 36 .90		70		Moon 1 L.	5	11 49 8 .06	
60		Moon 2 L.	5	4 24 22 .32				Moon 2 L.	5	11 51 14 .58	
		τ Tauri	5	4 32 1 .32				η Virginis	5	12 11 34 .52	
		ι Tauri	5	4 52 54 .60			April 8	ε Geminorum	5	6 33 41 .96	− 0 .66
	Nov. 15	σ Aquarii	5	22 21 18 .10	− 0 .56	71		Moon 1 L.	5	7 7 28 .52	
61		Moon 1 L.	5	22 56 51 .92				ι Geminorum	5	7 15 24 .10	
		φ Aquarii	5	23 5 9 .90				β Geminorum	5	7 35 8 .04	
		k′ Piscium	5	23 17 51 .46			9	ι Geminorum	5	7 15 23 .44	− 0 .66

* Limb somewhat deficient.

No.	Date.	Star.	No. Wires Obs.	Meridian Transit.	Clock's Rate.
	1840.				
	April 9	β Geminorum	5	7^h 35^m $7^s.38$	
72		Moon 1 L.	5	8 8 56.38	
		θ Cancri	5	8 22 4.50	
		δ Cancri	5	8 35 12.0	
	11	λ Leonis	5	9 22 10.80	— $0^s.69$
		o Leonis	5	9 32 12.14	
73		Moon 1 L.	5	9 57 30.94	
		ρ Leonis	5	10 23 59.48	
	13	χ Leonis	5	10 56 19.92	— 0.53
		q Leonis	5	11 8 37.50	
74		Moon 1 L.	5	11 32 40.64	
		β Virginis	5	11 41 56.16	
		b Virginis	5	11 50 19.74	
	15	γ' Virginis	5	12 33 6.68	— 0.60
75		Moon 1 L.	5	13 3 56.32	
		α Virginis	5	13 16 19.42	
	19	b Scorpii	5	15 40 53.56	— 0.60
		δ Scorpii	5	15 50 24.22	
		α Scorpii	5	16 19 7.88	
76		Moon 2 L.	5	16 25 49.72	
	May 10	χ Leonis	5	10 56 1.50	— 0.95
77		Moon 1 L.	5	11 18 4.58	
		υ Leonis	5	11 28 1.44	
78	June 8	Moon 1 L.	5	12 34 48.80	— 1.10
		ψ Virginis	5	12 45 58.08	
		g Virginis	5	12 59 27.18	
	9	ψ Virginis	5	12 45 56.96	— 1.19
		g Virginis	5	12 59 25.92	
79		Moon 1 L.	5	13 20 35.66	
		x Virginis	5	13 41 6.48	
	11	λ Virginis	5	14 10 20.94	— 0.64
		20 Libræ	5	14 54 37.06	
80		Moon 1 L.	3	14 56 50.39	
81	13	Moon 1 L.	5	16 42 16.70	— 0.64
		A Ophiuchi	5	17 5 23.84	
		θ Ophiuchi	5	17 12 4.78	
	July 3	α Leonis	5	9 59 21.84	— 1.15
82		Moon 1 L.	5	10 41 55.24	
	6	γ' Virginis	5	12 33 1.40	— 1.15
83		Moon 1 L.	5	13 3 35.24	
		α Virginis	5	13 16 14.44	
84	8	Moon 1 L.	5	14 39 18.96	— 0.80
		α² Libræ	5	14 41 29.06	
		20 Libræ	2	14 54 10.35	
	9	α² Libræ	4	14 41 28.46	— 0.66
		20 Libræ	5	14 54 9.62	
85		Moon 1 L.	5	15 30 11.86	
		b Scorpii	5	15 40 48.86	
		δ Scorpii	5	15 60 19.94	
	10	b Scorpii	5	15 40 47.60	— 1.04
		δ Scorpii	5	15 50 19.12	
		α Scorpii	5	16 19 2.40	
86		Moon 1 L.	5	16 23 22.96	
	1840.				
	July 10	τ Scorpii	5	16^h 25^m $22^s.38$	
	11	α Scorpii	5	16 19 1.64	— $0^s.83$
		τ Scorpii	5	16 25 21.48	
87		Moon 1 L.	5	17 18 22.48	
		1² Ophiuchi	5	17 21 5.08	
		Sagittarii	5	17 48 14.76	
	13	φ Sagittarii	1	18 35 3.84	— 0.88
88		Moon 1 L.	5	19 9 25.46	
		χ' Sagittarii	5	19 14 56.24	
		h² Sagittarii	5	19 26 22.42	
	15	v Capricorni	5	20 30 18.46	— 0.87
89		Moon 2 L.	5	20 56 57.74	
		s Capricorni	5	21 6 15.52	
		ε Capricorni	5	21 27 28.86	
90	16	Moon 2 L.	5	21 46 27.36	— 0.87
		ι Aquarii	5	21 57 8.56	
		θ Aquarii	5	22 7 43.70	
91	Aug. 4	Moon 1 L.	5	14 19 48.04	— 1.09
		α² Libræ	5	14 41 2.48	
	5	α² Libræ	5	14 41 1.46	— 1.02
92		Moon 1 L.	5	15 10 17.72	
93	6	Moon 1 L.	5	16 3 53.98	— 1.03
		σ Scorpii	2	16 11 27.08	
		α Scorpii	5	16 19 35.32	
	7	σ Scorpii	5	16 11 26.18	— 1.00
		α Scorpii	5	16 19 34.22	
94		Moon 1 L.	5	16 58 23.66	
		A Ophiuchi	5	17 5 29.60	
		θ Ophiuchi	5	17 12 10.20	
95	8	Moon 1 L.	5	17 54 1.00	— 1.32
		γ² Sagittarii	4	17 55 29.47	
		λ Sagittarii	5	11 18 3.02	
	9	γ² Sagittarii	5	17 55 28.12	— 1.46
		λ Sagittarii	5	18 18 1.44	
96		Moon 1 L.	5	18 49 38.90	
		τ Sagittarii	5	18 56 52.98	
		χ' Sagittarii	5	19 15 28.10	
	11	β² Capricorni	5	20 11 54.14	— 1.32
97		Moon 1 L.	5	20 36 55.94	
		μ Aquarii	5	20 43 54.14	
	13	δ Capricorni	5	21 38 2.72	— 1.32
		ι Aquarii	5	21 57 38.12	
98		Moon 2 L.	5	22 18 54.78	
		η Aquarii	5	22 26 58.06	
		λ Aquarii	5	22 44 5.80	
	14	η Aquarii	5	22 26 56.78	— 1.20
		λ Aquarii	5	22 44 4.68	
99		Moon 2 L.	5	23 7 4.06	
		λ Piscium	5	23 33 41.86	
	17	ε Piscium	4	0 54 22.41	— 1.48
100		Moon 2 L.	5	1 37 0.18	
		β Arietis	3	1 45 32.28	
	21	β Tauri	5	5 15 47.96	— 1.01

No.	Date.	Star.	No. Wires Obs.	Meridian Transit.	Clock's Rate.
	1840.				
101	Aug. 21	Moon 2 L.	5	5^h 45^m $11^s.34$	
	31	α Virginis	4	13 16 13 .46	— $1^s.26$
102		Moon 1 L.	5	13 59 11 .44	
	Sept. 6	φ Sagittarii	5	18 35 2 .88	— 0 .89
		σ Sagittarii	5	18 44 44 .10	
103		Moon 1 L.	5	19 21 29 .18	
		h^2 Sagittarii	5	19 26 21 .54	
		57 Sagittarii	5	19 42 17 .26	
	7	57 Sagittarii	5	19 42 16 .26	— 1 .00
104		Moon 1 L.	5	20 14 50 .88	
		π Capricorni	5	20 17 31 .82	
		υ Capricorni	5	20 30 18 .60	
	12	n Piscium	5	23 39 0 .44	— 0 .95
		ω Piscium	5	23 50 22 .94	
105		Moon 2 L.	5	0 26 35 .12	
		δ Piscium	5	0 39 40 .48	
		ε Piscium	5	0 53 55 .86	
	13	δ Piscium	5	0 39 39 .34	— 0 .91
		ε Piscium	5	0 53 55 .18	
106		Moon 2 L.	5	1 18 49 .86	
		η Piscium	5	1 22 12 .44	
		β Arietis	5	1 45 5 .18	
	14	β Arietis	5	1 45 4 .30	— 0 .88
107		Moon 2 L.	5	2 14 25 .34	
		ν Arietis	5	2 28 59 .92	
		ε Arietis	5	2 49 19 .92	
	17	τ Tauri	5	4 31 51 .16	— 0 .98
		ι Tauri	5	4 52 44 .34	
108		Moon 2 L.	5	5 24 6 .30	
	Oct. 3	δ Sagittarii	5	18 9 38 .84	— 1 .32
		λ Sagittarii	5	18 17 59 .38	
109		Moon 1 L.	5	18 59 0 .20	
		π Sagittarii	2	19 0 8 .15	
		h^2 Sagittarii	5	19 26 51 .96	
	5	c Sagittarii	5	19 52 39 .90	— 1 .23
		β^2 Capricorni	5	20 11 52 .22	
110		Moon 1 L.	5	20 44 6 .64	
		η Capricorni	5	20 55 8 .92	
		s Capricorni	5	21 6 44 .04	
	6	η Capricorni	5	20 55 7 .02	— 1 .71
		s Capricorni	5	21 6 42 .52	
111		Moon 1 L.	5	21 34 12 .84	
		δ Capricorni	5	21 38 1 .78	
		ι Aquarii	5	21 57 36 .98	
112	7	Moon 1 L.	5	22 23 17 .48	— 1 .22
		η Aquarii	5	22 26 55 .94	
		λ Aquarii	5	22 44 4 .12	
	12	ψ Arietis	5	2 21 45 .34	— 1 .07
113		Moon 2 L.	5	2 51 33 .20	
		δ Arietis	5	3 2 12 .30	
		g Arietis	5	3 14 35 .22	
	13	g Arietis	5	3 14 34 .50	— 0 .92

No.	Date.	Star.	No. Wires Obs.	Meridian Transit.	Clock's Rate.
	1840.				
114	Oct. 13	Moon 2 L.	5	3^h 55^m $41^s.28$	
		υ' Tauri	5	4 16 26 .96	
		τ Tauri	5	4 32 21 .60	
	Nov. 2	υ Capricorni	2	20 30 16 .08	— $1^s.11$
115		Moon 1 L.	5	21 11 39 .18	
		γ Capricorni	5	21 30 33 .40	
		δ Capricorni	5	21 37 32 .28	
116	3	Moon 1 L.	5	22 0 1 .92	— 1 .35
		θ Aquarii	5	22 7 41 .68	
		σ Aquarii	5	22 21 29 .50	
	5	κ^2 Piscium	5	22 51 41 .58	— 0 .77
		γ Piscium	5	23 8 8 .70	
117		Moon 1 L.	5	23 36 22 .88	
		n Piscium	5	23 38 59 .38	
		ω Piscium	5	23 50 22 .30	
	6	n Piscium	5	23 38 58 .36	— 1 .10
		ω Piscium	5	23 50 21 .12	
118		Moon 1 L.	5	0 26 44 .44	
		δ Piscium	5	0 39 38 .78	
		ε Piscium	5	0 53 54 .40	
	9	ν Arietis	5	2 28 57 .78	— 1 .18
		ε Arietis	5	2 49 17 .78	
119		Moon 1 L.*	3	3 22 2 .34	
		Moon 2 L.	5	3 24 34 .44	
		η Tauri	5	3 37 12 .62	
		A' Tauri	5	3 54 28 .44	
	10	η Tauri	5	3 37 11 .08	— 1 .36
		A' Tauri	5	3 54 27 .26	
120		Moon 2 L.	5	4 32 44 .74	
		ι Tauri	5	4 52 45 .02	
		β Tauri	5	5 15 23 .24	
	15	q Cancri	5	9 9 9 .22	— 0 .80
		ξ Leonis	5	9 22 26 .00	
121		Moon 2 L.	5	9 51 25 .58	
		α Leonis	5	9 58 57 .68	
	16	ν Leonis	5	9 48 42 .46	— 1 .02
		α Leonis	5	9 58 56 .66	
122		Moon 2 L.	5	10 42 3 .18	
	30	ι Capricorni	5	21 13 12 .36	— 1 .36
123		Moon 1 L.	5	21 41 14 .08	
		μ Capricorni	5	21 44 26 .16	
		30 Aquarii	5	21 54 43 .36	
	Dec. 1	μ Capricorni	5	21 44 25 .44	— 0 .83
		30 Aquarii	5	21 54 42 .28	
124		Moon 1 L.	5	22 27 59 .24	
		κ Aquarii	3	22 29 19 .30	
		λ Aquarii	5	22 44 7 .42	
	2	κ Aquarii	5	22 29 18 .06	— 1 .26
		λ Aquarii	5	22 44 6 .14	
125		Moon 1 L.	5	23 14 39 .38	
		k' Piscium	5	23 18 34 .26	
		λ Piscium	5	23 33 43 .20	

* Limb somewhat deficient.

III. Observed Occultations of fixed Stars at Hudson Observatory.

No.	Date.	Star.	Immersion. Siderial Time.	Emersion. Siderial Time.	Remarks.
	1839.				
1	Oct. 17	δ Capricorni	21^h 56^m $48^s.79$	22^h 10^m $7^s.79$	Imm. pretty good; Em. tolerable.
	1840.				
2	April 11	α Leonis		10 48 13 .54	Tolerable observation.
3	" 19	τ Scorpii	16 36 44 .15	17 33 50 .65	Imm. uncertain to 2^s or 3^s; Em. good.
4	May 6	μ' Cancri	11 32 43 .00		Good.
5	" "	* 7 Mag.	11 37 42 .20		Good.
6	Oct. 13	η Phiadum		20 29 12 .94	Perhaps 3^s or 4^s late.
7	Nov. 2	ι Capricorni	20 44 50 .52	22 1 19 .57	Imm. tolerable; Em. perhaps 2^s late.

IV. Second Comet of 1840.

On the 14th of March, 1840, I received a letter from Mr. S. C. Walker, containing the elements of two comets recently discovered at the Berlin Observatory by Mr. Galle, accompanied by an intimation that one of them might be still visible. I immediately computed an ephemeris, and on the first succeeding pleasant evening, the 18th, readily found it nearly in the place expected. I observed it afterwards, on the 19th, 21st, and 25th of March, as, also, on the 1st and 2d of April. After this there was no clear evening until the 7th, when I searched for it in vain. The atmosphere was quite transparent, and there was nothing to interfere with observations but the moon, now five days old. I did not search for it afterwards. When first discovered, the comet was faint, but brightest in the central parts, resembling a small nebula, nearly circular, and about one minute in diameter; but its margin was exceedingly ill-defined. On the 19th the nucleus was remarked to be somewhat eccentric, and on the lower side of the comet, as seen in an inverting telescope. No remarkable change in the comet's appearance was subsequently observed, except that its brightness diminished somewhat more rapidly than had been anticipated. As it would not bear an illumined field, I could make no use of the spider-line micrometer, and was compelled to confine myself to a more inconvenient and less satisfactory mode of observing. For right ascension, I brought the comet into the middle of the field of the equatorial, and counted the seconds elapsed between its egress from the field and that of some neighbouring star. This process was repeated six or eight times. For declination, I again brought the

comet into the middle of the field, and, by rapidly turning the screw of the declination circle, brought it to the margin of the field. The graduation, which is to 10″, was then read off. I performed the same operation with the star of comparison, and repeated the process several times. These observations occupied nearly the whole of the evening that the comet could be conveniently observed. I thus obtained *differences* of right ascension and declination between the comet and known stars. The following table exhibits a summary of the observations. The place of α Arietis is from the Nautical Almanac; of θ' Arietis from Pond's Catalogue of 1112 Stars; and of η and ψ Arietis from the Astronomical Society's Catalogue.

1840.	Siderial Time at Hudson.	Star.	Mag.	Apparent Places of the Stars. A. R.	Apparent Places of the Stars. Dec.	Comet minus Star. A. R.	Obs.	Comet minus Star. Dec.	Obs.
March 18	$7^h\ 45^m\ 28^s.67$	α Arietis	3	$1^h\ 58^m\ 9^s.76$		+ $32^s.80$	5		
	7 56 12 .98				+ 22° 42′ 16″.3			+ 7′ 30″.9	2
19	7 39 15 .25			1 58 9 .76		+ 140 .94	8		
	7 40 38 .96				+ 22 42 16 .2			— 25 14 .2	3
21	8 11 13 .89	η Arietis	6	2 3 50 .54		+ 12 .80	10		
	7 39 26 .77				+ 20 27 20 .6			+ 47 11 .8	3
25	8 7 43 .76	θ' Arietis	6	2 9 14 .21		+ 85 .80	5		
	8 29 19 .58				+ 19 9 34 .9			+ 5 48 .2	4
April 1	8 45 10 .65	ψ Arietis	6		+ 16 59 44 .1			— 51 42 .9	1
2	8 49 41 .00			2 22 2 .12		+ 38 .00	3		
	8 24 21 .01				+ 16 59 44 .2			— 77 29 .3	2

From these data we obtain the apparent places of the comet affected by parallax, and the *difference* of refraction of the comet and stars of comparison. In the following table these corrections are applied, and the times reduced to Berlin Observatory, by adding $6^h\ 19^m\ 22^s.3$ for difference of longitude.

1840.	Berlin Mean Time.	Comet's A. R.	Comet's Dec.
March 18	$14^h\ 18^m\ 12^s.34$	29° 40′ 43″.8	
	14 28 54 .89		+ 22° 49′ 51″.8
19	14 8 4 .04	30 7 45 .1	
	14 9 27 .52		22 17 5 .9
21	14 32 5 .63	31 1 2 .5	
	14 0 23 .72		21 14 49 .0
25	14 12 52 .44	32 40 7 .8	
	14 34 24 .72		19 15 35 .1
April 1	14 22 41 .82		16 7 29 .7
2	14 23 15 .53	35 39 25 .0	
	13 57 59 .69		15 42 2 .0

Continuation of Mr. Loomis' Paper. Read April 16, 1841.

Being desirous of determining the comet's orbit with the greatest possible accuracy, I sought for a collection of European observations. For such as I have obtained I am indebted to the kindness of Mr. S. C. Walker. They embrace thirty-four observations at Hamburg, from January 29th to March 24th, which are published in an abridged form in the Society's proceedings, Vol. I., p. 275; twenty-six observations at Bonn, from February 3d to March 19th, given in connexion with Kysæus' Ephemeris, in the Astronomische Nachrichten, No. 399; and twelve observations at Berlin, from January 25th to February 21st. These, together with my own, make seventy-eight observations, and are all which I have been able to obtain. In comparing the observations I availed myself of Kysæus' Ephemeris, which was found to represent the comet's course tolerably well. The Hamburg observations are given more fully in the Astronomische Nachrichten, Nos. 402 and 405. The comet's place for February 4th, $17^h\ 47^m$, does not accord with the other observations, and I have therefore rejected it, presuming it must contain some error, and have employed the mean of the remaining observations for the same evening. The declination for March 1st is also obviously erroneous, and I have rejected it entirely. The Hamburg places are called *apparent*, by which I understand that they are corrected for refraction merely. I have computed the correction for parallax, and applied it to each observation. The Berlin observations were supposed to have been already corrected for parallax. The following table exhibits the corrections of Kysæus' Ephemeris by each of the observations:

			Corrections.		
			A. R.	Dec.	
Jan.	25	Berlin	— 2″.7	+ 1″.7	
	26	"	— 24 .6	+ 10 .4	
	27	"	+ 8 .2	+ 3 .7	
	29	"	+ 39 .1	— 6 .6	
	29	Hamburg	+ 9 .4	— 33 .9	
	30	Berlin	+ 21 .0	— 3 .7	
	30	Hamburg	+ 18 .2	— 13 .3	
Feb.	2	Berlin	+ 25 .1	— 10 .9	1.
	2	Hamburg	0 .0	— 23 .3	
	3	Berlin	+ 16 .1	— 8 .4	
	3	Hamburg	+ 20 .3	— 27 .5	
	3	Bonn	+ 29 .5	+ 4 .9	
	4	Hamburg	+ 7 .3	— 7 .5	
	4	Bonn	+ 39 .0	+ 1 .0	
	8	Hamburg	— 8 .6	+ 16 .3	
	8	Bonn	+ 1 .5	— 1 .3	
	9	Berlin	+ 4 .6	— 11 .1	
	9	Hamburg	— 17 .8	+ 8 .9	
	11	Berlin	— 21 .3	— 4 .6	
	11	Hamburg	— 8 .2	+ 1 .9	
	11	Bonn	— 8 .4	— 3 .2	2.
	12	Hamburg	— 8 .0	+ 10 .2	
	12	Bonn	— 27 .5	— 26 .5	
	13	Hamburg	— 16 .7	+ 4 .3	
	13	Bonn	— 25 .9	— 20 .1	
	17	Hamburg	— 15 .9	+ 7 .7	
	17	Bonn	— 12 .3	+ 3 .5	
	19	Berlin	— 21 .8	+ 2 .8	
	20	Berlin	— 18 .0	+ 3 .3	
	20	Hamburg	— 14 .6	+ 4 .0	
	21	Berlin	— 8 .1	+ 5 .5	
	21	Hamburg	— 30 .5	+ 1 .3	
	21	Bonn	— 2 .4	— 4 .4	
	22	Hamburg	— 28 .0	+ 9 .7	
	22	Bonn	— 22 .9	— 0 .6	3.
	23	Hamburg	— 10 .2	+ 10 .4	
	23	Bonn	— 7 .7	+ 15 .2	
	24	Hamburg	— 18 .5	+ 2 .5	
	24	Bonn	— 7 .1	+ 15 .3	
	25	Hamburg	— 24 .0	+ 7 .1	
	25	Bonn	— 8 .6	+ 18 .2	
	26	Bonn	— 28 .6	+ 23 .4	
	27	Bonn	— 25 .2	+ 11 .9	

			Corrections.		
			A. R.	Dec.	
Feb.	28	Hamburg	— 35″.6	+ 18″.4	
	28	Bonn	— 27 .6	+ 18 .4	
	29	Hamburg	— 39 .4	+ 24 .3	
	29	Bonn	— 24 .4	+ 16 .9	
March	1	Hamburg	— 27 .2		
	1	Bonn	— 20 .0	+ 14 .0	
	2	Bonn	— 25 .6	+ 22 .7	
	3	Hamburg	— 31 .8	+ 12 .0	4.
	3	Bonn	— 21 .3	+ 19 .0	
	4	Hamburg	— 25 .9	+ 17 .8	
	4	Bonn	— 24 .5	+ 17 .0	
	5	Hamburg	— 39 .5	+ 6 .3	
	5	Bonn	— 23 .5	+ 17 .6	
	6	Hamburg	— 32 .4	+ 19 .9	
	6	Bonn	— 20 .9	+ 21 .5	
	7	Hamburg	— 41 .7	+ 23 .5	
	7	Bonn	— 27 .5	+ 15 .4	
	8	Bonn	— 30 .4	+ 22 .2	
	9	Hamburg	— 32 .4	+ 24 .1	
	11	Hamburg	— 39 .5	+ 25 .2	5.
	11	Bonn	— 32 .1	+ 22 .1	
	16	Hamburg	— 30 .0	+ 25 .0	
	17	Hamburg	— 22 .3	+ 22 .4	
	18	Hamburg	— 28 .5	+ 17 .9	
	18	Hudson	— 41 .6	+ 26 .3	
	19	Bonn	— 33 .2	+ 22 .7	
	19	Hudson	— 45 .4	— 23 .3	
	20	Hamburg	— 53 .1	+ 23 .9	
	21	Hamburg	— 26 .9	+ 35 .0	
	21	Hudson	— 42 .3	+ 0 .6	6.
	22	Hamburg	— 40 .4	+ 20 .7	
	24	Hamburg	— 34 .6	+ 23 .5	
	25	Hudson	— 42 .5	+ 18 .3	
April	1	Hudson		+ 61 .7	
	2	Hudson	— 56 .0	+ 27 .2	

The preceding observations I have divided into six groups, and taken the average of all the corrections. This may be regarded as the mean error of the ephemeris for the middle date of each group, and applying this correction to the ephemeris with an opposite sign, we obtain the comet's true places. The

Hudson observations in right ascension accord with each other quite as well as the European observations; the declinations seem entitled to very little weight. The results are shown in the following table.

Berlin Mean Time.	Corrections of Ephemeris.		Comet's Places by Ephemeris.		Corrected Places freed from Aberration.	
	A. R.	Dec.	A. R.	Dec.	A. R.	Dec.
Jan. 31, 8^h	+ 14″.7	— 8″.1	326° 24′ 50″.6	+ 61° 25′ 23″.5	326° 25′ 5″.3	+ 61° 25′ 15″.4
Feb. 12,	— 12 .7	— 1 .1	358 8 37 .6	51 2 51 .8	358 8 24 .9	51 2 50 .7
23,	— 17 .3	+ 7 .8	13 19 53 .3	40 11 24 .7	13 19 36 .0	40 11 32 .5
Mar. 3,	— 28 .0	+ 17 .6	21 1 45 .4	32 39 1 .4	21 1 17 .4	32 39 19 .0
12,	— 32 .6	+ 22 .4	26 35 13 .5	26 27 52 .4	26 34 40 .9	26 28 14 .8
24,	— 40 .2	+ 25 .0	32 10 37 .8	19 51 50 .7	32 9 57 .6	19 52 15 .7

It is important to know the probable error of the preceding results. If we regard the corrections in each group as observed values of the *same* quantity, we obtain the probable error of the mean by the formula $E = \sqrt{\frac{.4549\,\Sigma\,(\chi - a)^2}{n\,(n-1)}}$.

These errors are exhibited below, those in right ascension being each multiplied by the cosine of the corresponding declination. The last column represents the probable error of the entire observation, being equal to $\sqrt{\text{A. R. error}^2 + \text{Dec. error}^2}$.

	A. R.	Dec.	Total Error.
January 31,	1″.5	2″.3	2″.7
February 12,	1 .1	2 .3	2 .5
23,	1 .1	1 .3	1 .7
March 3,	.9	.8	1 .2
12,	1 .3	.7	1 .5
24,	1 .7	.8	1 .9

The supposition that the correction of the Ephemeris remains constant throughout the entire period embraced by one group is incorrect, and we should obtain a more satisfactory result if we knew the proper correction of the Ephemeris for the date of each observation. As, however, the above corrections follow no obvious law, it is impossible to obtain, very satisfactorily, the correction for each date by interpolation. I have therefore contented myself with the above numbers, and conclude that if an orbit can be found, whose errors are confined within these limits, nothing more can reasonably be demanded. The preceding right ascensions and declinations were converted into longitudes and latitudes by employing the apparent obliquity of the ecliptic,

and the longitudes were referred to the mean equinox of January 1, 1840, by applying the precession and nutation.

The perturbations remained to be computed. In this operation I followed the method of Bessel for the comet of 1807. I employed intervals of eighteen days, the middle days of the several intervals being February 9th, February 27th, and March 16th. The values of A, B, and C for their dates, being the united effects of the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, and Uranus, expressed in ten thousand millionth parts of a unit, are as follow:

	A.	B.	C.
February 9,	— 115342	— 39226	+ 64303
27,	— 81595	— 61489	+ 36573
March 16,	— 104112	— 76746	+ 25572

From these are deduced

	A′.	B′.	C′.
February 9,	+ 22805	+ 132129	— 31608
27,	— 44625	+ 98296	— 11076
March 16,	— 98327	+ 83979	— 25737

Hence were computed the variations of the elements of the comet's orbit for each interval of eighteen days, and from them the total amount of variation from January 31st to March 25th. The perturbations in longitude and latitude were thence deduced for January 31st, February 18th, March 7th, and March 25th, from which were obtained, by interpolation, the perturbations for intermediate dates. The following is the result:

	Longitude.	Latitude.
January 31,	0″.0	0″.0
February 12,	0 .0	— 1 .1
23,	— 0 .2	— 1 .9
March 3,	— 0 .4	— 2 .3
12,	— 0 .7	— 2 .5
24,	— 1 .1	— 2 .7

Applying these corrections with opposite sign to the comet's observed places, we obtain the places such as they would have been observed had it not been for the disturbing action of the planets. The following table exhibits the comet's corrected places, together with those of the earth for the same times, from the Nautical Almanac.

Berlin Mean Time.	Comet. Longitude.	Comet. Latitude.	Earth. Longitude.	Earth. Latitude.	Earth. Log Radius Vector.
Jan. 31, 8^h	15° 0′ 50″.0	+ 65° 37′ 49″.6	131° 3′ 29″.6	+ 0″.3	9.9936814
Feb. 12,	24 50 22 .3	46 10 41 .5	143 12 42 .4	— .7	9.9945791
23,	29 22 27 .8	31 27 35 .5	154 17 46 .9	+ .5	9.9956259
March 3,	32 2 14 .6	22 0 28 .2	163 19 40 .4	— .1	9.9966147
12,	34 14 5 .2	14 26 39 .0	172 19 2 .2	— .4	9.9976458
24,	36 45 4 .7	6 27 27 .7	184 13 40 .3	+ .7	9.9991232

The longitudes are referred to the mean equinox of January 1, 1840. Assuming Kysæus' approximate elements, the preceding places furnished me twelve equations of condition, from which were deduced the following parabolic elements, by the method of minimum squares:

Perihelion passage, Berlin mean time, March 12. 981921.

Longitude of perihelion, ...	80° 20′ 24″.4
" ascending node, . .	236 48 39 .3
Inclination of orbit, ...	59 14 2 .4
Log. of perihelion distance, . . .	0.0870185.

The errors of this orbit are as follow, the errors in longitude being multiplied by the cosine of the corresponding latitude:

	Longitude.	Latitude.
January 31,	+ 4″.4	+ 2″.6
February 12,	— 1 .4	— 1 .9
23,	— 6 .1	+ 1 .5
March 3,	— 2 .7	— 1 .7
12,	+ .1	— .7
24,	+ 5 .9	+ 1 .1

These errors certainly are not very great, yet they exceed what has already been assigned as the limit of the probable error of the observations. It is, then, probable that the orbit was not a parabola, especially as the errors follow an obvious law, the extremes being positive, and the middle ones generally negative. It remains to vary the other element, namely, the eccentricity. This was done by means of the following equations of condition, computed by the formulæ of Gauss and Bessel, in which the variations of the elements were

$$d = 0.0002$$
$$t = 0.01$$
$$p = n = i = 1'$$
$$e = 0.001$$

The first six of the following equations are dependent upon the longitudes, and are severally multiplied by the cosine of the corresponding latitude.

$E = -32.625\,\delta$	$+\ 6.603\,\tau$	$+\ 30.109\,\pi$	$-\ 32.467\,\nu$	$+\ 40.720\,\iota$	$-\ 4.672\,\varepsilon$
$E = -23.385$	$-\ 0.510$	$+\ 10.100$	$-\ 28.875$	$+\ 36.707$	$-\ 5.400$
$E = -17.756$	$-\ 4.192$	$-\ 1.295$	$-\ 25.476$	$+\ 27.782$	$-\ 3.631$
$E = -14.750$	$-\ 6.078$	$-\ 7.428$	$-\ 22.914$	$+\ 20.407$	$-\ 1.879$
$E = -12.881$	$-\ 7.296$	$-\ 11.611$	$-\ 20.726$	$+\ 13.814$	$-\ 0.186$
$E = -11.604$	$-\ 8.241$	$-\ 15.225$	$-\ 18.389$	$+\ 6.335$	$+\ 2.002$
$E = +24.462$	$-\ 34.932$	$-\ 64.694$	$+\ 22.945$	$+\ 19.768$	$-\ 34.780$
$E = +16.770$	$-\ 35.444$	$-\ 61.086$	$+\ 30.666$	$-\ 1.309$	$-\ 26.121$
$E = +\ 7.297$	− [illegible].135	$-\ 51.018$	$+\ 32.773$	$-\ 8.379$	$-\ 14.846$
$E = +\ 1.240$	− [illegible]7.124	$-\ 43.649$	$+\ 32.861$	$-\ 8.888$	$-\ 6.763$
$E = -\ 3.118$	$-\ 23.649$	$-\ 38.145$	$+\ 32.375$	$-\ 7.202$	$-\ 0.600$
$E = -\ 7.146$	$-\ 20.085$	$-\ 33.374$	$+\ 31.510$	$-\ 3.734$	$+\ 5.529$

From these equations I obtained the following elliptic elements:

Perihelion passage, Berlin mean time, March 13. 158768.

Longitude of perihelion, ...	80° 12′ 3″.52
" ascending node, . .	236 50 34 .67
Inclination of orbit, ...	59 12 36 .14
Log. of perihelion distance, . . .	0.0865202
Eccentricity, ...	0.99323412
Semi-axis major, . .	180.383
Periodic time, . . .	2422.6 years.

The errors of this orbit are as follow:

	Longitude.	Latitude.	Total Error.
January 31,	+ 0″.6	+ 1″.8	1″.9
February 12,	+ 0 .4	− 3 .9	3 .9
23,	− 2 .6	+ 2 .0	3 .3
March 3,	+ 0 .1	+ 0 .6	0 .6
12,	+ 0 .5	+ 1 .1	1 .3
24,	+ 0 .9	− 1 .5	1 .7

The total error of four of the observations is less than the limit of probable error before determined, and that of the other two is greater. The excess and defect are nearly equal. On the whole, then, the accordance is highly satisfactory. The sum of the squares of the errors in the elliptic orbit is 34.62; in

the parabolic, 117,85. There seems, then, no room for hesitation in the choice between the two orbits. It is much to be regretted that observations could not have been made for a longer time after the perihelion passage. They would have served to determine, with greater accuracy, the eccentricity of the orbit, an element which must now be admitted to be liable to considerable uncertainty.

ERRATA

IN PROFESSOR LOOMIS' ASTRONOMICAL OBSERVATIONS, 1ST SERIES, VOL. VII.

Page 44, line 22, for "pin" read "pier."
45, 10, for "division" read "divisions."
45, 21, for "120°" read "110°."
45, 31, for "pin" read "pier."
50, 44, first column, for "o Capricorni" read "θ Capricorni."
51, 8, for "Piradum" read "Pleiadum."

ERRATA IN PROFESSOR LOOMIS' SECOND MAGNETIC ARTICLE, VOL. VII.

Page 102, line 24, for "Aug. 18" read "Aug. 19."
103, 105, 107, 109, 111, running title, for "dips" read "dip."
106, line 11, for "8^h" read "4^h."
106, line 12, for "Hampton" read "Hamden."

ERRATA IN PROFESSOR LOOMIS' STORM ARTICLE, VOL. VII.

Page 125, line 10, for "seems" read "seemed."
125, 19, for "Register" read "Regents."
127, 46, for "Casinovia" read "Cazenovia."
127, 47, for "Genornem" read "Gouverneur."
130, 11, for "nich" read "inch."
141, 4, for "ships" read "ship."
145, 31, for "Rendues" read "Reudus."
146, 25, for "appearances" read appearance."